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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/190,207	11/13/1998	JIASHU CHEN	CHEN-4	6396

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EXAMINER	
NGUYEN, DUC MINH	

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2643	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/190,207	Applicant(s) CHEN, JIASHU	
	Examiner Duc Nguyen	Art Unit 2643	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on ____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-12 is/are pending in the application.

4a) Of the above claim(s) ____ is/are withdrawn from consideration.

5)☐ Claim(s) ____ is/are allowed.

6)☒ Claim(s) 1-12 is/are rejected.

7)☐ Claim(s) ____ is/are objected to.

8)☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on ____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date ____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (5,500,900).

Consider claim 1. Chen teaches a head-related transfer function model for use (in any event, "**for use**" is not a positive structural limitation) with 3D sound applications, comprising (a) a plurality of Eigen filters (fig 5a, #42 & 43); (b) a plurality of spatial characteristic functions are adaptively combined with said plurality of Eigen filters (fig 5a, #106 & 107); and (c) a plurality of regularizing models (the spline model, col 5, lines 66 - 67 through col 6, lines 1 -5) adapted to regularize said plurality of spatial characteristic functions (fig 5a, #107 & 108) prior to said respective combination with said plurality of Eigen filters (fig 5a, #51 & 52). The spline method explains that the regularizing is done in the STCF's and FETF's measurements (col 5, lines 18 - 43). Chen also teaches time domain filtering as an alternative (where the basic filters are implemented in the time domain rather than the frequency domain, **the process of convolution is carried out on the input signal and basic filters in impulse response form**; col. 6, ln. 56 to col. 7, ln. 5). Chen further teaches free-field-to-eardrum transfer functions (FETF's), also known as head related transfer functions (HRTF's) (col. 1, ln. 40-50). Chen also teaches that H (ω,θ,Φ) is the measured FETF (i.e., HRTF) at some azimuth θ and elevation Φ,

the overall model response, can be expressed as the equation (1) (col. 4, ln. 11-13; see also col. 3, ln. 56 to col. 7, ln. 5). Chen clearly admits in (col. 6, ln. 56 to col. 7, ln. 5) that in the above example, the filtering of components is performed in the frequency domain, but it should be apparent that equivalent examples could be set up to filter components in the time domain [**Emphasis added**]. Chen further admits in (col. 7, ln. 1-5) that where the basic filters are implemented in the time domain rather then the frequency domain, the process of convolution is carried out on the input signal and the basic filters in impulse response form [**Emphasis added**]. According to Chen's admission, equation (1) can be expressed in time domain transfer function (i.e., the impulse response form if the basic filters has the same form as equation (1) with the spatially variant terms $w_i(\theta,\Phi)$ separated from the time-dependent terms in the impulse response) (col. 6, ln. 56 to col. 7, ln. 5). It would have been obvious to one of ordinary skill in the art that in case equation (1) expressed in time domain or impulse response form as admitted by Chen, all of the remaining equations (e.g., 1' to 7) are also expressed and calculated in impulse response forms. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize and process the teachings of Chen in time domain in order to provide shorter processing time, since implementations and operation in frequency domain transfer functions are often slow (because the use of FFT and IFFT). Moreover, Column(s) 5, line(s) 5-43 clearly shows that the STCF's $w_i(\theta, \Phi)$, $i = 1, \ldots, p$, are obtained by fitting a spline function over azimuth and elevation variables to STCF samples. Moreover, equations (5), (6), and (7) are computed based on a plurality of variables. In short, the regularizing model of Chen provides a plurality of HRTF's with varying degrees of smoothness.

Consider claim 2. Chen further teaches the head-related transfer function model for use (in any event, "for use" is not a positive structural limitation) with 3D sound applications further comprising a summer (fig 5a, # 80 & 81) operably coupled to the plurality of combined Eigen filters combined with the plurality of regularized spatial characteristic functions to provide the head-related transfer function model (fig 5a, #51 and 52).

Consider claim 3. Chen further teaches the plurality of regularizing models are each adapted to perform a generalized spline model (col 5, lines 66-67 through col 6, lines 1-5). The spline method explains that the regularizing is done in the STCF's and FETF's measurements (col 5, lines 18-43).

Consider claim 4. Chen further teaches a smoothness control operably coupled with the plurality of regularizing models to allow control of a trade-off between localization and smoothness of the head-related transfer function (col 5, lines 27-43).

Consider claim 5. Chen teaches a head-related impulse response model for use (in any event, "**for use**" is not a positive structural limitation) with 3D sound applications, comprising a plurality of Eigen filters (fig 5a, # 51 & 52); a plurality of spatial characteristic functions are adapted to be respectively combined with the plurality of Eigen filters (fig 5a, #106 & 107); and a plurality of regularizing models adapted to regularize the plurality of spatial characteristic functions (fig 5a, #106 & 107) prior to the respective combination with the plurality of Eigen filters (fig 5a, #51 & 52). (The ref. for this claim is in col 5, lines 29 43). Chen also teaches time domain filtering as an alternative (where the basic filters are implemented in the time domain rather than the frequency domain, **the process of convolution is carried out on the input signal and basic filters in impulse response form**; col. 6, ln. 56 to col. 7, ln. 5). Chen further teaches

free-field-to-eardrum transfer functions (FETF's), also known as head related transfer functions (HRTF's) (col. 1, ln. 40-50). Chen also teaches that H (ω,θ,Φ) is the measured FETF (i.e., HRTF) at some azimuth θ and elevation Φ, the overall model response, can be expressed as the equation (1) (col. 4, ln. 11-13; see also col. 3, ln. 56 to col. 7, ln. 5). Chen clearly admits in (col. 6, ln. 56 to col. 7, ln. 5) that in the above example, the filtering of components is performed in the frequency domain, but it should be apparent that equivalent examples could be set up to filter components in the time domain [**Emphasis added**]. Chen further admits in (col. 7, ln. 1-5) that where the basic filters are implemented in the time domain rather then the frequency domain, the process of convolution is carried out on the input signal and the basic filters in impulse response form [**Emphasis added**]. According to Chen's admission, equation (1) can be expressed in time domain transfer function (i.e., the impulse response form if the basic filters has the same form as equation (1) with the spatially variant terms $w_i(\theta,\Phi)$ separated from the time-dependent terms in the impulse response) (col. 6, ln. 56 to col. 7, ln. 5). It would have been obvious to one of ordinary skill in the art that in case equation (1) expressed in time domain or impulse response form as admitted by Chen, all of the remaining equations (e.g., 1' to 7) are also expressed and calculated in impulse response forms. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize and process the teachings of Chen in time domain in order to provide shorter processing time, since implementations and operation in frequency domain transfer functions are often slow (because the use of FFT and IFFT). Moreover, the regularization HRTF filter produced by summing Eigen filters and regularized spatial characteristics functions is met by the FETF model (step 37 in fig(s). 4). Also see column(s) 6, line(s) 6-15.

Consider claim 6. Chen further teaches the head-related impulse response model for use (in any event, "for use" is not a positive structural limitation) with 3D sound applications further comprising a summer adapted to sum the plurality of combined Eigen filters combined with the plurality of regularized spatial characteristic functions to provide the head-related impulse response model (fig 5a, # 80 & 81).

Consider claim 7. Chen further teaches the plurality of regularizing models are each adapted to perform a generalized spline model (spline model explained at col 5, lines 1-43).

Consider claim 8. Chen further teaches a smoothness control in communication with the plurality of regularizing models to allow control of a trade-off between localization and smoothness of the head-related transfer function (col 5, lines 28-33).

Consider claims 9-12. Chen teaches a method of determining spatial characteristic sets for use (in any event, "**for use**" is not a positive structural limitation) in a head-related transfer function model, comprising constructing a covariance data matrix of a plurality of measured head-related transfer functions (col 4, lines 40-67); performing an Eigen decomposition of the covariance data matrix to provide a plurality of Eigen vectors (col 4, lines 14 - 55); determining at least one principal Eigen vector from the plurality of Eigen vectors (col. 4, ln. 39 to col. 5, ln. 4; col 6, lines 14 - 49); and projecting the measured head-related transfer functions back to the at least one principal Eigen vector to create the spatial characteristic sets (fig. 4, steps 30-35; col 5 & 6, lines 56 - 67 and 1 - 23). Chen teaches use of frequency domain functions, and frequency domain filtering. Chen also teaches time domain filtering as an alternative (where the basic filters are implemented in the time domain rather than the frequency domain, **the process of convolution is carried out on the input signal and basic filters in impulse response form**;

col. 6, ln. 56 to col. 7, ln. 5). Chen further teaches free-field-to-eardrum transfer functions (FETF's), also known as head related transfer functions (HRTF's) (col. 1, ln. 40-50). Chen also teaches that H (ω,θ,Φ) is the measured FETF (i.e., HRTF) at some azimuth θ and elevation Φ, the overall model response, can be expressed as the equation (1) (col. 4, ln. 11-13; see also col. 3, ln. 56 to col. 7, ln. 5). Chen clearly admits in (<u>col. 6, ln. 56 to col. 7, ln. 5</u>) that in the above example, the filtering of components is performed in the frequency domain, but it should be apparent that equivalent examples could be set up to filter components in the time domain [**Emphasis added**]. Chen further admits in (col. 7, ln. 1-5) that where the basic filters are implemented in the time domain rather then the frequency domain, the process of convolution is carried out on the input signal and the basic filters in <u>impulse response form</u> [**Emphasis added**]. According to Chen's admission, equation (1) can be expressed in time domain transfer function (i.e., the impulse response form if the basic filters has the same form as equation (1) with the spatially variant terms $w_i(\theta,\Phi)$ separated from the time-dependent terms in the impulse response) (col. 6, ln. 56 to col. 7, ln. 5). It would have been obvious to one of ordinary skill in the art that in case equation (1) expressed in time domain or impulse response form as admitted by Chen, all of the remaining equations (e.g., 1' to 7) are also expressed and calculated in impulse response forms. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize and process the teachings of Chen in time domain in order to provide shorter processing time, since implementations and operation in frequency domain transfer functions are often slow (because the use of FFT and IFFT). Moreover, Column(s) 5, line(s) 5-43 clearly shows that the STCF's $w_i(\theta, \Phi)$, $i = 1, \ldots, p$, are obtained by fitting a spline function over azimuth and elevation variables to STCF samples. Moreover,

equations (5), (6), and (7) are computed based on a plurality of variables. In short, the regularizing model of Chen provides a plurality of HRTF's with varying degrees of smoothness.

Response to Arguments

3. Applicant's arguments filed 11/22/04 have been fully considered but they are not persuasive.

Regarding the Chen reference, applicant states that Chen fails to teach or suggest a plurality of regularizing models to regularize a plurality of spatial characteristic functions and spatial characteristic sets prior to a respective combination with a plurality of Eigen filters to provide a plurality of HRTF's with varying degrees of smoothness. In contrast to applicant's assertions, Column(s) 5, line(s) 5-43 clearly shows that the STCF's $w_i(\theta, \Phi)$, $i = 1, \ldots, p$, are obtained by fitting a spline function over azimuth and elevation variables to STCF samples. Moreover, equations (5), (6), and (7) are computed based on a plurality of variables. In short, the regularizing model of Chen provides a plurality of HRTF's with varying degrees of smoothness. On page(s) 4, line(s) 13-17 and page(s) 6, line(s) 29-30 and page(s) 7, line(s) 1-4 of applicant's specification disclose "**[A] generalized spline model for regularization for interpolation and smoothing**" and "the regularizing models 212-216 in the disclosed embodiment **performs [A] so-called generalized spline model function**". Furthermore, fig(s). 2 of the pending application is clearly met by fig(s). 4 of Chen. For instance, steps 102-114 of the pending application are corresponding to steps 31-37 of Chen. The mere fact that a given structure is integral does not preclude its consisting of various elements, Nerwin v. Erlicman, 168 USPQ 177, 179 (PTO Bd. Of Int. 1969).

Regarding the Chen reference, applicant states that Chen fails to teach a single regularization HRTF filter produced by summing Eigen filters and regularized spatial characteristics functions. In contrast to applicant's assertions, the regularization HRTF filter produced by summing Eigen filters and regularized spatial characteristics functions is met by the FETF model (step 37 in fig(s). 4). Also see column(s) 6, line(s) 6-15.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duc Nguyen whose telephone number is 703-308-7527. The examiner can normally be reached on 6:00AM-2:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Kuntz can be reached on 703-305-4708. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Duc Nguyen
Primary Examiner
Art Unit 2643

3/8/05